Wildlife Diversity Small Grants Program Project:

The Distribution of the Sturgeon Chub (*Macrhybopis gelida*) in South Dakota.

Prepared by:

George R. Cunningham &
Susanne M. Hickey
2041 N. 66th St.
Omaha, NE 68104
(402) 561-9422

Prepared for:

South Dakota Department of Game, Fish and Parks
Wildlife Division, Wildlife Diversity Small Grants Program
c/o Doug Backlund, Biologist

Evaluation of the project is based on the following criteria:

1. How beneficial is the project to native wildlife and native plants species? The project should seek to provide new knowledge, raise public awareness, or improve habitat.
2. How likely is the project to be successful? Projects must have a reasonable chance of being successful. Surveys of designated areas for rare species are not considered successful based only on the discovery of rare species. The documented absence of rare species is considered a successful survey if appropriate methods are used.
3. Is the applicant qualified to carry out the project? The applicant must have the appropriate experience or qualifications needed to complete the project.
4. Is the project cost effective? It is to the applicant's advantage to prepare a budget that is carefully prepared and economical. A minimal stipend is acceptable.
5. Projects must be compatible with the mission statement of Wildlife Division, as follows:

The Wildlife Division will manage South Dakota's wildlife and fisheries resources and their associated habitats for their sustained and enjoyable use by present and future generations.

Project Reports and Results:

The following projects were funded in 1997 and 1998. A summary of the results of these projects is presented in the following table. Reports are available from the Wildlife Diversity Small Grants Program.

Year	Grantee	Project	Completed	Report Received
1997	Cunningham, George and Susanne Hickey	The Distribution of the Sturgeon Chub (Macrhybopsis gelida) in South Dakota	Completed	Yes
1997	Droge, Dale and Jeff Palmer	Bird Population Study of Shelterbelt Habitats in Lake County, S.D.	Completed	Yes
1997	Hays, Nancy	Calling Surveys for Flammulated Owls and Northern Saw-Whet Owls in the Central and Southern Black Hills	Completed	Yes
1997	Johnson, Paul	Conifer Forest Dwelling Stateroid Beetles (Coleoptera: Cucujidae and Throscidae) of Western South Dakota and Adjacent Areas	Completed	Yes
1997	Olson, Ricky	Lake Chub Survey	Completed	Yes
1997	Swanson, Dave	Use of Shelterbelt Woodlands by Neotropical Migrant Birds in the Northern Great Plains	Completed	Yes
1998	Cunningham, George	Eastern Woodrat Survey	Incomplete	
1998	Gabel, Audrey	A Survey to Identify and Document Mushrooms and Other Fleshy Fungi in the Black Hills of South Dakota	Completed, funded again in 1999	Yes
1998	Olson, Ricky	Sturgeon Chub and Lake Chub Survey	Completed	Yes
1998	Pederson, Clarence	Spring Creek Nature Trail	Completed	Yes
1998	Swanson, Dave	Ecology and Management of the Restricted Pine-Juniper-Grassland Habitat in Southwestern South Dakota	Completed	Yes

Reports should be cited as follows:

EXAMPLE: Cunningham, George and Susanne Hickey. 1997. The Distribution of the Sturgeon Chub (*Macrhybopsis gelida*) in South Dakota. South Dakota Wildlife Diversity Small Grants Results and Reports: 1997-1998. South Dakota Department of Game, Fish and Parks, Pierre, S.D. 1999. GFP Report 99-12.

INTRODUCTION

The sturgeon chub, (*Macrhybopis gelida*), is currently a state–threatened cyprinid (minnow) species believed to have been extirpated from South Dakota after a survey in 1989-1990 specifically designed to study this species found no sturgeon chubs in the State (Werdon 1992). Prior to this work, the last record of the sturgeon chub in SD was from the Little Missouri River in 1976 (Bich & Scalet, 1977). Moreover, in the North Dakota portion of the Little Missouri River, the sturgeon chub was once classified as fairly common (Reigh & Elsen, 1979), but river surveys conducted in the last decade have failed to find this species and reintroduction efforts have been discussed (North Dakota Game and Fish Department, 1996). The sturgeon chub has not only declined significantly in the Dakotas, but throughout much of its former range (Werdon, 1993).

More recently however, the sturgeon chub was found at a limited number of sites in the White, Little White and Cheyenne Rivers in 1994 (Cunningham, Olson and Hickey, 1995). In light of these data, a project to delineate the distribution of the sturgeon chub in the Cheyenne, Little Missouri, Little White, and White Rivers of South Dakota was initiated under the Wildlife Diversity Small Grants Program administered by Wildlife Division of the South Dakota Department of Game, Fish and Parks (SDGF&P). The emphasis of this study was to determine if extant sturgeon chub populations were present in South Dakota. In addition, the data collected during this study will help heritage biologist assess what sites, if any, are best suited for habitat conservation efforts.

METHODS

The aim of this fish survey was to sample every highway bridge crossing of the Cheyenne, Little Missouri, Little White, and White Rivers. The White and Little White Rivers were surveyed from their mouths to near the border of Nebraska. The Cheyenne River was surveyed at every crossing from its mouth to Angostura Reservoir. The Little Missouri was surveyed at every river crossing from the Wyoming border to the North Dakota border. In addition, we canoed the Little Missouri River from Salmen Ford north approximately 11 miles and sampled at various locations throughout this stretch of river.

All the survey sites were sampled using two different seines: a standard wall seine (2.44m x 1.25m with 6.3mm mesh) and a standard bag seine (3.66m x 1.25m with 6.3mm mesh and a capture bag of 1.04 m^3). Standard two person seine hauls were performed at each survey site, which covered at least one–hundred meters, this allowed all possible habitat types to be sampled as least once. In addition, a generalized description of the site was recorded (Appendix II).

Fish specimens were fixed in a 10% formalin solution for initial preservation. The specimens were stored in the formalin solution for a minimum of four weeks, rinsed and set in a large volume of distilled water for 24 hr, then transferred to a 70% ethanol solution for final preservation and storage.

RESULTS AND DISCUSSION

Sturgeon chubs were found to be present at 12 sites within 3 of the 4 rivers (White, Cheyenne and Little White Rivers). In the White River, 10 of 12 sampling sites contained sturgeon chubs, and at several locations they were abundant (>10 individuals collected). Sturgeon chubs appear to be a major component of the White River fish fauna. The river, for most of its length, was a wide, very turbid river with gravel, sand substrates and exposed gravel/sand bars, which were present at many of the sites. In addition, the bank structure along the White River was unconfined or slightly confined and a variety of depths were present, creating fast as well as slow water habitats. The 2 sites on the White River where sturgeon chubs were not collected were the 2 furthest upstream sites (sites WH11 & WH12). The river at these locations was much different morphologically than the downstream sites. The upstream sites were deeper and faster flowing, had a relatively narrow channel, and the river banks were steeply sloped, creating a confined, slightly incised river (Appendix II). All total of 115 sturgeons were observed in the White River, and some individuals were preserved as voucher specimens (Appendix I).

The Cheyenne River was sampled at 7 sites, but sturgeon chubs were found at only 1 site. This site was located at the old State Highway 34 bridge (site CH2, Appendix I). The river at this site was very wide, had a swift current, and a gravel, boulder and sand substrate. Sampling efforts at the State Highway 34 crossing (just east of the old bridge site) found no sturgeon chubs. This site also represents the furthest downstream sampling site (extended periods of high water prevented sampling at State Highway 63). Interestingly, sturgeon chubs were not collected at the Wasta site (site CH3) during this survey, but they were collected in 1994 (Cunningham et al. 1995). Moreover, we did not collect this species at the State Highway 44 site (site CH4) in Pennington County, yet specimens were collected from this site in 1995 (SD Heritage Database). The Belle Fourche River was sampled at 1 location north of Elm Springs, SD, but no sturgeon chubs were found.

The 2 upstream sites (sites CH6 and CH7) on the Cheyenne River (sturgeon chubs were not found at these locations) were physically different in character than the rest of the Cheyenne River sites; these sites were much narrower and had greater water clarity (Appendix II). The site near Oral, SD was similar in appearance to a mountain trout stream,

the substrate was mostly boulders with some gravel and very clear water. The Buffalo, SD site was slightly more turbid than the Oral site but not nearly as turbid as the river downstream. The substrate here was gravel and rubble with some boulders. Unlike the other sites downstream on the Cheyenne, neither of these sites contained exposed gravel/sand bars. The river conditions at these 2 upstream sites are heavily influence by the presence of Angostura Reservoir. Material entering the reservoir from the west settles out behind the dam, thus very clear water is released downstream. The river conditions at these site are not conducive to sturgeon chubs, this species prefers river habitat that is highly turbid with substrate material composed of gravel, rubble and sand.

Sturgeon chubs were collected in the Little White River, but only at 1 location, which was just upstream from the mouth of this river (site LWR1). Although this species was collected at State Highway 83 in 1994 (Cunningham et al. 1995), it was not collected during the course of this survey. The turbidity of the Little White River, except near its mouth, is much less than that of the White River. The substrate composition of the lower section of Little White River is mostly sand with boulders and shale bedrock. The upper sections of the Little White River in Bennett County were very narrow (1-4 m wide) in comparison to the lower reach. The water clarity was high and the stream substrate was sand and gravel, but more sand than gravel. The structural and functional differences in the upper reach of the Little White River not only prohibits stream–use by sturgeon chubs but flathead chubs as well. These species are adapted to large streams with the combined characteristics of high turbidity and gravel, sand substrates.

The fourth and most intensively surveyed stream was the Little Missouri River, unfortunately, no sturgeon chubs were collected. This species had been collected in this river previously (Bich and Scalet 1977, Reigh and Elsen 1979), however, recent surveys by the USFWS (Wade King, pers. comm.) and the North Dakota Game and Fish Department in 1997 found no sturgeon chubs in the Little Missouri River in North Dakota. Interestingly, during the course of our survey, we found many of the same cyprinid species in the Little Missouri River as previous studies (Personius and Eddy 1955, Bailey and Allum 1962, and Bich and Scalet 1977) but no sturgeon chubs. This species appears to have been extirpated from this river system.

The reason for this extirpation is unclear since the habitat structure in the Little Missouri River appears conducive to sturgeon chub use. The river is wide, free flowing, turbid, and possesses a large number of exposed gravel bars throughout its length in SD. Reasons for this species demise have centered around the drought of the late 1980's and the activities related to oil and gas drilling (North Dakota Game and Fish Department 1996). The effect of drought as an explanation for the sturgeon chubs disappearance is dubious,

some refugia habitat would have been available to at least a segment of the river's sturgeon chub population during extreme periods of dryness. The direct or indirect effects of fossil fuel development within the river basin is difficult to assess. Questions concerning the effect of saline concentrations and/or some other contaminate from drilling operations (injection wells and overflow) on the functioning of the extremely numerous, well developed sensory structures of sturgeon chubs (Davis and Miller 1967) needs much more research in order to answer.

Another factor in this complex question of sturgeon chub persistence may be the relationship of this species to turbidity and a morphologically similar species, the longnose dace. Qualitative analysis of the species collection data from this survey appears to indicate that under very turbid conditions (i.e., White River) longnose dace are virtually absent, but sturgeon chubs are common to abundant. A similar phenomenon was observed by Stewart (1981) in the Powder River of Wyoming. Applying the same logic, rivers with less turbid conditions (i.e., Cheyenne and the Little White Rivers) have far fewer or no sturgeon chubs present. Although the numbers of other fish species at each site were not recorded during this survey, the presence of longnose dace in the Little Missouri River drainage at 11 of the 18 sites might indicate the turbidity of the river has changed over the last 2 decades. Has the emphasis on productive grazing management and soil erosion control created a less turbid Little Missouri River? This question requires more research to fully answer.

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Appendix I. Fish species identified during surveys on the Cheyenne, Little Missouri, Little White, and White Rivers.

LITTLE MISSOURI RIVER

LMR1 Little Missouri River, Harding Co., T21N R2E, sec 16; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Cyprinus carpio	common carp
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Pimephales promelas	fathead minnow

LMR2 Little Missouri River, Harding Co., T21N R2E, sec 16; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Catostomus commersoni	white sucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

LMR3 Little Missouri River, Harding Co., T21N R2E, sec 16; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hiodon alosoides	goldeye
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

LMR4 Little Missouri River, Harding Co., T21N R2E, sec 15; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LMR5 Little Missouri River, Harding Co., T21N R2E, sec 9; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LMR6 Little Missouri River at Kimble Creek, Harding Co., T21N, R2E, sec 9; Date: 28 May 1997.

Scientific Name	Common Name
Pimephales promelas	fathead minnow

LMR7 Little Missouri River, Harding Co., T21N R2E, sec 8; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner

LMR8 Little Missouri River, Harding Co., T21N R2E, sec 5; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LMR9 Little Missouri River, Harding Co., T21N R2E, sec 4; Date: 28 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hiodon alosoides	goldeye
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace
Stizostedion canadense	sauger

LMR10 Little Missouri River, Harding Co., T22N R2E, sec 28; Date: 28 May 1997.

Scientific Name	Common Name
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow

LMR11 Little Missouri River, Harding Co., T22N R2E, sec 21; Date: 29 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Moxostoma macrolepidotum	shorthead redhorse
Notropis stramineus	sand shiner

LMR12 Little Missouri River, Harding Co., T22N R2E, sec 21; Date: 29 May 1997.

Scientific Name	Common Name
Hiodon alosoides	goldeye
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LMR13 Little Missouri River, Harding Co., T22N R2E, sec 16; Date: 29 May 1997.

Scientific Name	Common Name
Hiodon alosoides	goldeye
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LMR14 Little Missouri River, Harding Co., T22N R2E, sec 8; Date: 29 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace
Stizostedion canadense	sauger

LMR15 Little Missouri River, Harding Co., T22N R2E, sec 5&8; Date: 29 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LMR16 Little Missouri River, Harding Co., T22N R2E, sec 5; Date: 29 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner

LMR17 Little Missouri River at Arnett Creek, Harding Co., T23N R2E, sec 32; Date: 29 May 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Hiodon alosoides	goldeye
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner

LMR18 Little Missouri River, Harding Co., T23N R2E, sec 29; Date: 29 May 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub

BE1 Boxelder Creek, Harding Co., T23N R1E, sec 22; Date: 29 May 1997.

Scientific Name	Common Name
Hiodon alosoides	goldeye
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

CHEYENNE RIVER

CH1 Cheyenne River (Hwy 34 bridge), Haakon Co., T7N R18e, sec 34; Date: 5 July 1997.

Scientific Name	Common Name
Cyprinella lutrensis	red shiner
Cyprinus carpio	common carp
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

CH2 Cheyenne River (old Hwy 34 bridge), Haakon Co., T7N R18E, sec 31; Date: 5 July. 1997

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Cyprinella lutrensis	red shiner
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (3 individuals, 1 preserved)
Macrhybopsis gracilis	flathead chub
Moxostoma macrolepidotum	shorthead redhorse
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Rhinichthys cataractae	longnose dace

CH3 Cheyenne River, Pennington Co., T1N R14E, sec 2; Date: 5 July 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gracilis	flathead chub
Moxostoma macrolepidotum	shorthead redhorse
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

CH4 Cheyenne River (Hwy 44), Pennington Co., T2S R12E, sec 2; Date: 7 October 1997.

Scientific Name	Common Name
Cyprinella lutrensis	red shiner
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub

CH5 Cheyenne River (near Redshirt), Custer Co., T4S R11E, sec 21; Date: 7 October 1997.

Scientific Name	Common Name
Fundulus zebrinus	plains killifish (2 individuals, both preserved)
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Moxostoma macrolepidotum	shorthead redhorse
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

CH6 Cheyenne River (E of Buffalo), Custer Co., T6S R9E, sec 29; Date: 6 October 1997.

Scientific Name	Common Name
Catostomus commersoni	white sucker
Cyprinella lutrensis	red shiner
Cyprinus carpio	common carp
Fundulus sciadicus	plains topminnow (numerous found, 0 preserved)
Fundulus zebrinus	plains killifish (numerous found, 1 preserved)
Hybognathus argyritus	silvery minnow
Lepomis macrochirus	bluegill
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow
Semotilus atromaculatus	creek chub
Moxostoma macrolepidotum	shorthead redhorse

CH7 Cheyenne River (near Oral), Fall River Co., T7S R7E, sec 28; Date: 6 October 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Fundulus sciadicus	plains topminnow (numerous found, 0 preserved)
Hybognathus argyritus	silvery minnow
Lepomis cyanellus	green sunfish
Lepomis humilis	orangespotted sunfish
Micropterus dolomieu	smallmouth bass
Moxostoma macrolepidotum	shorthead redhorse
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Pimephales promelas	fathead minnow
Semotilus atromaculatus	creek chub

BF1 Belle Fourche River, Meade Co., T5N R13E, sec 29; Date: 5 July 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Catostomus commersoni	white sucker
Cyprinella lutrensis	red shiner
Cyprinus carpio	common carp
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

WHITE RIVER

WH1 White River (S of Reliance), Lyman Co., T103N R73W, sec 3; Date: 5 October 1997.

Scientific Name	Common Name
Hiodon alosoides	goldeye
Dorosoma cepedianum	gizzard shad
Hybognathus argyritus	silvery minnow
Macrhybopsis gelida	sturgeon chub (38 individuals, 6 preserved)
Macrhybopsis gracilis	flathead chub
Notropis atherinoides	emerald shiner

WH2 White River (S of Kennebec), Lyman Co., T103N R75W, sec 22; Date: 5 October 1997.

Scientific Name	Common Name
Dorosoma cepedianum	gizzard shad
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (2 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub
Notemigonus crysoleucas	golden shiner

WH3 White River (Hwy 183), Lyman Co., T103N R77W, sec 21 & 22; Date: 5 October 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Cyprinus carpio	common carp
Dorosoma cepedianum	gizzard shad
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (9 individuals, 3 preserved)
Macrhybopsis gracilis	flathead chub
Pimephales promelas	fathead minnow
Moxostoma macrolepidotum	shorthead redhorse

WH4 White River (S of Vivian), Lyman Co., T103N R79W, sec 20&21; Date: 5 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (22 individuals, 4 preserved)
Macrhybopsis gracilis	flathead chub
Carpiodes carpio	river carpsucker

WH5 White River (S of Murdo), Mellette Co., T43N R28W, sec 8; Date: 5 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (10 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub

WH6 White River (N of Cedar Butte) Mellette Co., T45N R31W, sec 21 & 28; Date: 6 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (9 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub
Moxostoma macrolepidotum	shorthead redhorse
Noturus flavus	stonecat
Rhinichthys cataractae	longnose dace

WH7 White River (S of Belevedere), Jackson Co., T44N R33W, sec 9; Date: 6 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Macrhybopsis gelida	sturgeon chub (7 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub

WH8 White River (S of Kadoka), Jackson Co., T44N R35W, sec 31; Date: 6 October 1997.

Scientific Name	Common Name
Cyprinus carpio	common carp
Hybognathus argyritus	silvery minnow
Macrhybopsis gelida	sturgeon chub (12 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub

WH9 White River (S of Interior), Jackson Co., T43N R39W, sec 14; Date: 6 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (2 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub
Pimephales promelas	fathead minnow

WH10 White River, Shannon Co., T41N R43W, sec 19; Date: 6 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Macrhybopsis gelida	sturgeon chub (4 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub

WH11 White River (N of Oglala), Shannon Co., T39N R46W, sec 32; Date: 8 October 1997.

Scientific Name	Common Name
Carpiodes carpio	river carpsucker
Cyprinus carpio	common carp
Hybognathus argyritus	silvery minnow
Macrhybopsis gracilis	flathead chub

WH12 White River (W of Pine Ridge), Shannon Co., T36N R47W, sec 24; Date: 8 October 1997.

Scientific Name	Common Name
Cyprinella lutrensis	red shiner
Hiodon alosoides	goldeye
Macrhybopsis gracilis	flathead chub
Moxostoma macrolepidotum	shorthead redhorse
Notropis stramineus	sand shiner
Rhinichthys cataractae	longnose dace

LITTLE WHITE RIVER

LWR1 Little White River, Mellette Co., T43N R28W, sec 9; Date: 5 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Ictalurus punctatus	channel catfish
Macrhybopsis gelida	sturgeon chub (6 individuals, 0 preserved)
Macrhybopsis gracilis	flathead chub
Pimephales promelas	fathead minnow

LWR2 Little White River (Hwy 83), Mellette Co., T42N R29W, sec 22&23; Date: 5 October 1997.

Scientific Name	Common Name
Cyprinella lutrensis	red shiner
Cyprinus carpio	common carp
Ictalurus punctatus	channel catfish
Macrhybopsis gracilis	flathead chub
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow
Pomoxis annularis	white crappie
Rhinichthys cataractae	longnose dace

LWR3 Little White River (W of White River, SD), Mellette Co., T42N R29W, sec 34; Date: 5 October 1997.

Scientific Name	Common Name
Hybognathus argyritus	silvery minnow
Lepomis macrochirus	bluegill
Macrhybopsis gracilis	flathead chub
Noturus flavus	stonecat
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace
Semotilus atromaculatus	creek chub

LWR4 Little White River (S of Swett), Bennett Co., T37N R39W, sec 33;
Date: 8 October 1997.

Scientific Name	Common Name
Catostomus commersoni	white sucker
Cyprinella lutrensis	red shiner
Cyprinus carpio	common carp
Lepomis cyanellus	green sunfish
Lepomis macrochirus	bluegill
Moxostoma macrolepidotum	shorthead redhorse
Notropis stramineus	sand shiner
Noturus flavus	stonecat
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

LWR5 Little White River (Hwy 73, S of Martin), Bennett Co., T37N R37W sec 31&32;
Date: 8 October 1997.

Scientific Name	Common Name
Ameiurus melas	black bullhead
Cyprinella lutrensis	red shiner
Notropis stramineus	sand shiner
Pimephales promelas	fathead minnow
Rhinichthys cataractae	longnose dace

APPENDIX II. Survey site descriptions for the Cheyenne, Little Missouri, Little White, and White Rivers.

LITTLE MISSOURI RIVER

General Description: River flows primarily through rangeland, although some cropland was also noted. Steep, high cliffs are quite common. Water depth varied from 0.20 m to 1.3 m; width: approximately 20 m. Substrate composed principally of gravel and rubble, but boulders are present at many sites. Water was moderately turbid and swift.

LMR1 Little Missouri River, Harding Co., T21N R2E, sec 16; 28 May 1997.
Site Description: Gravel, boulder bars with numerous cottonwood and willow seedlings. Water is high due to recent rains.

LMR2 Little Missouri River, Harding Co., T21N R2E, sec 16; 28 May 1997.
Site Description: Boulder and gravel bars exposed.

LMR3 Little Missouri River T21N R2E, sec 16; 28 May 1997.
Site Description: Gravel, boulder bars and a back water area were sampled.

LMR4 Little Missouri River, T21N R2E, sec 15; 28 May 1997.
Site Description: Gravel bar and coarse sand on the right bank; a high, steep bank is present on the left side (2 golden eagle nests are located on the cliff).

LMR5 Little Missouri River, T21N R2E, sec 9; 28 May 1997.
Site Description: Boulder bars were sampled.

LMR6 Kimble Creek mouth, Harding Co., T21N, R2E, sec 9; 28 May 1997.
Site Description: Silty, clay substrate.

LMR7 Little Missouri River, T21N R2E, sec 8; 28 May 1997.
Site Description: Sampled along a grass-covered island. The river substrate was composed primarily of gravel.

LMR8 Little Missouri River, T21N R2E, sec 5; Date: 28 May 1997.
Site Description: Sampled a gravel bar.

LMR9 Little Missouri River, Harding Co., T21N R2E, sec 4; Date: 28 May 1997.
Site Description: Several seeps were present on the steep bank flowing into the river. Sampled along slower flowing area along the bank.

LMR10 Little Missouri River, Harding Co., T22N R2E, sec 28; Date: 28 May 1997.
Site Description: A small tributary enters the river at this location.

LMR11 Little Missouri River, Harding Co., T22N R2E, sec 21; Date: 29 May 1997.
Site Description: Sampled gravel bar. A high cliff is present on the left bank.

LMR12 Little Missouri River, Harding Co., T22N R2E, sec 21; Date: 29 May 1997.
Site Description: Sampled along gravel, boulder bar.

LMR13 Little Missouri River, Harding Co., T22N R2E, sec 16; Date: 29 May 1997.
Site Description: Sampled both along a gravel bar and through riffles.

LMR14 Little Missouri River, Harding Co., T22N R2E, sec 8; Date: 29 May 1997.
Site Description: Sampled along gravel bars.

LMR15 Little Missouri River, Harding Co., T22N R2E, sec 5&8; Date: 29 May 1997.
Site Description: Sampled along gravel bar.

LMR16 Little Missouri River, Harding Co., T22N R2E, sec 5; Date: 29 May 1997.
Site Description: Sampled backwater area along a gravel bar.

LMR17 Little Missouri River at Arnett Creek, Harding Co., T23N R2E, sec 32;
Date: 29 May 1997.
Site Description: Sampled where creek enters the river. Rapids were located just downstream on the river. The creek was mucky and slow flowing.

LMR18 Little Missouri River, Harding Co., T23N R2E, sec 29; Date: 29 May 1997.
Site Description: Sampled a side channel just up from the ford/crossing.

BE1 Boxelder Creek, Harding Co., T23N R1E, sec 22; Date: 29 May 1997.
Site Description: Wide with rock riffles and gravel substrate. Banks were vegetated with grasses (prairie cordgrass primarily).

CHEYENNE RIVER

CH1 Cheyenne River (Hwy 34 bridge), Haakon Co., T7N R18E, sec 34; Date: 5 July 1997.
Site Description: Gravel and boulder substrate with silt and some sand. Swift current slightly turbid to turbid.

CH2 Cheyenne River (old Hwy 34 bridge), Haakon Co., T7N R18E, sec 31;
Date: 5 July 1997.
Site Description: Gravel, boulder and sand substrate. Swift current, slightly turbid to turbid.

CH3 Cheyenne River (at Wasta), Pennington Co. , T1N R14E, sec 2; Date: 5 July 1997.
Site Description: Boulder and some sand. Swift moving water, turbid.

CH4 Cheyenne River (Hwy 44), Pennington Co., T2S R12E, sec 2; Date: 7 October 1997.
Site Description: Substrate was composed of boulders, rubble and some muck. Water depth to 0.65 m, width 20-30 m. Some green algae can be found. Bank vegetation was mostly grassland with some scattered trees. A gravel operation can be found just upstream from this site. Swift current slightly turbid to turbid.

CH5 Cheyenne River (near Redshirt), Custer Co., T4S R11E, sec 21;
Date: 7 October 1997.
Site Description: Substrate was composed of boulder, gravel and sand. Depth to 0.60 m, width 15 - 20 m. An open gravel bar exists along north bank. Banks were mostly grass covered (primarily cordgrass, some wheatgrass) with scattered cottonwoods. Swift current and slightly turbid

CH6 Cheyenne River (E of Buffalo), Custer Co., T6S R9E, sec 29; Date: 6 October 1997.
Site Description: Substrate was composed of gravel, rubble, some boulders all with a layer of silt. No exposed bars. Some aquatic vegetation including *Potemogeton crispus*, and *P.pectinatus*. Depth to 0.70 m, width approximately 20 m. Water clarity is high. Vegetation on the banks included prairie cordgrass, some cattails and scattered cottonwoods.

CH7 Cheyenne River (near Oral), Fall River Co., T7S R7E, sec 28; Date: 6 October 1997.
Site Description: Substrate was composed mostly of boulders with some areas of gravel. Depth to 0.75 m, width 10 - 15 m. Bank vegetation includes cottonwoods, willow shrubs, prairie cordgrass, *Scirpus* spp.. Green algae and *Potemogeton crispus* were abundant. Very low turbidity, swift current.

BF1 Belle Fourche River, Meade Co., T5N R13E, sec 29; Date: 5 July 1997.
Site Description: Boulder and some sand; exposed bars.

WHITE RIVER

The river from WH1 to WH10 was very turbid, river width was wide, and the substrate was a sand, gravel, rubble mixture. Sites WH11 and WH12 were narrow and downcut, lacking gravel/sandbars and appearing somewhat degraded.

WH1 White River (S of Reliance), Lyman Co., T103N R73W, sec 3;
Date: 5 October 1997.
Site Description: Sand, gravel and rubble substrate with gumbo on the edges. Water was very turbid and ranges in depth from 0.20 m to 0.75 m, approximately 50m wide. Landuse is primarily pasture with some cropland.

WH2 White River (S of Kennebec), Lyman Co., T103N R75W, sec 22;
Date: 5 October 1997
Site Description: Sand, gravel and rubble substrate with some gumbo on the edges. Depth ranged from 0.25 m to 0.75 m, width approximately 40 - 50 m. Water was very turbid.

WH3 White River (Hwy 183), Lyman Co., T103N R77W, sec 21 & 22;
Date: 5 October 1997.
Site Description: Substrate was mostly sand with some boulders and gravel. Water was very turbid and silt/gumbo has settled out along the banks. Depth averaged approximately 0.50m.

WH4 White River (S of Vivian), Lyman Co., T103N R79W, sec 20/21;
Date: 5 October 1997;
Site Description: Sand, gravel and hard clay (shale) substrate. Depth: 0.20 m - 0.60 m. Water is very turbid (less than 3 cm clarity). Land is primarily grassland dominated with willows and cottonwoods along the floodplain.

WH5 White River (S of Murdo), Mellette Co., T43N R28W, sec 8; Date: 5 October 1997.
Site Description: Sand and muck substrate with some boulders. Vegetation on the banks included scattered cottonwoods and grasses.

WH6 White River (N of Cedar Butte), Mellette Co., T45N R31W, sec 21 & 28;
Date: 6 October 1997.
Site Description: Boulder, rock substrate with gumbo along the edges. Depth was approximately 0.35 m. Water clarity less than 7 cm. Bank vegetation includes cottonwoods, boxelder, willow as well as cordgrass, goldenrod and sunflower.

WH7 White River (S of Belevedere), Jackson Co., T44N R33W, sec 9;
Date: 6 October 1997.
Site Description: Sand substrate with some gravel, rubble, gumbo on the edges. Depth was approximately 0.25 m, width approximately 40 m. Water clarity is approximately 10 cm. Flows through grassland with scattered cottonwoods.

WH8 White River (S of Kadoka), Jackson Co., T44N R35W, sec 31;
Date: 6 October 1997.
Site Description: Sand, gravel, boulder substrate. Average depth about 0.30 m, width approximately 40 m. River has exposed bars. Water approximately 7 cm. River flows through grassland with scattered cottonwoods.

WH9 White River (S of Interior), Jackson Co., T43N R39w, sec 14;
Date: 6 October 1997.
Site Description: Gravel and coarse sand substrate. Average depth about 0.25 m, width approximately 20 m. Water clarity 7-10 cm. River flows through grassland with scattered cottonwoods.

WH10 White River, Shannon Co., T41N R43W, sec 19; Date: 6 October 1997.
Site Description: Rubble, boulder and gravel substrate. Depth about 0.50m, width about 10 - 15 m. Water clarity approximately 10-12 cm. River flows through grassland with scattered cottonwoods.

WH11 White River (N of Oglala), Shannon Co., T39N R46W, sec 32;
Date: 8 October 1997.
Site Description: Stream appears to have been channelized with deep banks composed of gumbo. Substrate in the center of the stream includes boulders and gravel. Depth about 1.3 m, width approximately 10 m. No exposed bars. Banks are wooded with boxelder, green ash, cottonwoods, and willows. Herbaceous layer includes some cordgrass and buckbrush. Downed logs and trash were present in the stream itself.

WH12 White River (W of Pine Ridge), Shannon Co., T36N R47W, sec 24;
Date: 8 October 1997.
Site Description: Substrate composed primarily of boulders with some gravel. Pools and riffles can be found at this site. Depth to 0.5 m, width about 8-10 m. Forested banks with cordgrass also. Trash, logs and other debris could be found at the site.

LITTLE WHITE RIVER

LWR1 Little White River, Mellette Co., T43N R28W, sec 9; Date: 5 October 1997.
Site Description: Mostly sand substrate with some boulder, rock riffles. Depth averaged approximately 0.50 m. Less turbid than the White River (clarity approximately 12 cm). Vegetation includes cottonwoods, willows and grasses.

LWR2 Little White River, Mellette Co. (Hwy 83), T42N R29W, sec 22&23;
Date: 5 October 1997.
Site Description: Substrate was sand over slippery shale/clay with very little boulders. Depth averaged 0.50 m, width: 15 - 20 m.

LWR3 Little White River (W of White River, SD), Mellette Co., T43N R29W, sec 34;
Date: 5 October 1997.
Site Description: Sand with some boulders and some gumbo on the edges. Depth ranges from 0.30 m to 0.40 m. Water clarity was approximately 15 cm. Banks are forested with cottonwoods, willows and boxelder as well as cordgrass and false indigobush.

LWR4 Little White River (S of Swett), Bennett Co., T37N R39W, sec 33;
Date: 8 October 1997.
Site Description: Substrate composed primarily of rubble, boulders and sand. Width about 1.5 - 2.0 m, depth to 0.15 m. Grasses dominated the banks (primarily cordgrass).

LWR5 Little White River (Hwy 73, S of Martin), Bennett Co., T37N R37W, sec 31&32;
Date: 8 October 1997.
Site Description: Substrate composed primarily of sand and gravel. Width approximately 3 - 4 m, depth approximately 0.3 - 0.55 m. Stream flows through pasture.